SANbloc Series
RAID Controller Guide

P/N: MAN-FC2000-RAID

Revision: 1.0

January 2001

Corporate Headquarters:

Eurologic Systems Ltd.,
Maple House,
South County Business Park,
Leopardstown,
Dublin 18,
Ireland.

Disclaimer and Warranty

Disclaimer

EUROLOGIC reserves the right to make changes to this manual and the equipment described herein without notice. EUROLOGIC has made all reasonable effort to insure that the information in this manual is accurate and complete. However, EUROLOGIC shall not be liable for any technical or editorial errors or omissions made herein or for incidental, special, or consequential damage of whatsoever nature resulting from the furnishing of this manual, or operation and performance of equipment in connection with this manual.

All Trademarks acknowledged.

Warranty

Basic Warranty - In the absence of any optional warranty or continuing provisions by formal agreement, EUROLOGIC warrants its products in accordance with the schedules listed below. Purchaser hereafter mentioned refers at all times to the customer who purchased EUROLOGIC product(s).

SANbloc Warranty - Eurologic warrants SANbloc products of its manufacture to be free from defect in material and workmanship for a period of three (3) years from the date of shipment. During this period, if the customer experiences difficulties with a EUROLOGIC SANbloc system and is unable to resolve the problem via phone with EUROLOGIC Technical Support a Return Material Authorization (RMA) number will be issued for the faulty component. Following receipt of an RMA, the Purchaser is responsible for returning the product to

EUROLOGIC, freight prepaid. EUROLOGIC, upon verification of warranty, will repair or replace at its option the SANbloc component in question, and will then return the product to the Purchaser, freight prepaid.

Cable Warranty - All EUROLOGIC provided cables are warranted for ninety (90) days from the time of shipment. Questionable cables should be returned to EUROLOGIC, freight prepaid where they will be repaired or replaced by EUROLOGIC at its option and returned to the Purchaser, freight prepaid.

General Terms - The above warranties shall not apply to expendable components such as fuses, bulbs, and the like, nor to connectors, adapters, and other items not a part of the basic product. EUROLOGIC shall have no obligation to make repairs or to cause replacement required through normal wear and tear or necessitated in whole or in part by catastrophe, fault or negligence of the user, improper or unauthorized use of the product, or use of the product in such a manner for which it was not designed, or by causes external to the product, such as, but not limited to, power failure or air conditioning. EUROLOGIC's sole obligation hereunder shall be to repair or replace any defective product, and unless stated, pay return transportation costs for such replacement. Purchaser shall provide labor for removal of the defective product, shipping charges for return to EUROLOGIC and installation of its replacement. On-site services are not a part of this warranty. Above warranties are subject to change without notice.

Returned Material - Warranty claims must be received by EUROLOGIC within the applicable warranty period. A replaced product, or part thereof, shall become the property of EUROLOGIC and shall be returned to EUROLOGIC at Purchaser's expense. All returned material must be accompanied by a Return Materials Authorization (RMA) number assigned by EUROLOGIC. For RMA numbers contact EUROLOGIC Customer Support at:

Telephone: +353-1-2061333
1 800 2184921 (U.S. Customers)

Fax: +353-1-8478723

email: rma@eurologic.com

THE EXPRESSED WARRANTIES SET FORTH IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH OTHER WARRANTIES ARE HEREBY DISCLAIMED AND EXCLUDED BY EUROLOGIC. THESE STANDARD EXPRESS WARRANTIES ARE IN LIEU OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF EUROLOGIC FOR DAMAGES, INCLUDING BUT NOT LIMITED TO SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE PRODUCT.

Table of Contents

Disclaimer and Warranty 3

Disclaimer 3

Warranty 3

Preface 9

Audience 9

Conventions Used In This User Guide 9

Getting Support 10

FCC Statement 10

European Community Statement 11

Chapter 1: Introduction 13

Hardware Information 15

Main Processor 17
Control Store Memory 17
Flash PROM 17
Scalable Cache Memory 17
UART 17
LED Signals 18
Memory Controller/Hardware XOR Engine 18
Fibre Channel 18
Controller Board Connectors 18
Power Conversion 18
Battery Backup Unit Board 19

Chapter 2: Installing a RAID Controller 21

Installing a RAID Controller 21

Installing a RAID Controller 21
Upgrading a JBOD Array to a RAID Array 22

Equipment and parts necessary for upgrade 22
Upgrading from JBOD to RAID..... 22
Installing the Battery Backup Unit 24

Installing the Battery Backup Unit 24

Chapter 3: Fault Management 27

RAID Controller Status LEDs 27

Fibre Channel Controller LED Definitions 28

Appendix A: RAID Controller Specifications 29

Power 29

Power Requirements 29
Power Connections 29
Input Noise..... 29
Environmental Specifications 30

MTBF..... 30

Glossary of Terms.....31

Preface

This Installation Guide describes the installation and operation of the SANbloc Series. The following products are covered: SANbloc FC2100 Series (JBOD) and SANbloc FC2500 Series (RAID).

Audience

This Installation Guide is intended for use by the person installing and operating the SANbloc Series. This Installation Guide describes the operation of the SANbloc Series only. For details relating to the host system, refer to the documentation supplied with the host system.

Conventions Used In This User Guide

The following conventions are used throughout this Installation Guide.

Note: *A NOTE gives general information, such as helpful tips and references to related information.*

CAUTION: A CAUTION means take care. There is a risk of causing damage to the equipment or losing data.

WARNING: A WARNING means beware. There is a risk of electric shock or personal injury. Before working on the Storage Array be aware of the hazards that exist.

Getting Support

If you are having difficulties installing or operating your SANbloc Series you can contact our World Wide Support Centre for assistance at:

Telephone:	+353-1-2061333 or 1-800-2184921 (from U.S only)
email:	support@eurologic.com
WWW	http://www.eurologic.com/support

FCC Statement

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when operated in a commercial environment.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at his own expense.

Any changes or modifications to this equipment not expressly approved by Eurologic Systems Ltd. could void the user's authority to operate this equipment.

European Community Statement

This equipment complies with the following European directives:

EMC Directive 89/336/EEC and amending Directives 92/31/EEC and 93/68/EEC Low Voltage Directive 73/23/EEC.

Chapter 1: Introduction

The FC2500 Series RAID Controller is a high performance fibre channel host to fibre channel disk RAID controller, providing one fibre host channel and two fibre disk channels conforming to the Fibre Channel Arbitrated Loop (FC-AL) standards. The logical protocol used for both host and disk communications is 100MB/s Fibre Channel Protocol (FCP) SCSI over fibre.

The controller provides FC_AL host performance and fault tolerant RAID disk operations for Fibre Channel (FC) disk environments. The controller is an intelligent, caching controller that supports RAID levels 0, 1, 3, 5, 0+1, JBOD, 30 and 50. The controller allows multiple host to access the array of disk drives, which can be configured as one or more virtual devices (logical units).

The controller permits continuous access to the data in the event of a disk drive failure. The controller also provides continuous access to data in the event of a controller failure. This capability comes with a dual active controller system, using two FC2500 controllers that share access to the same array of disk drives. In the event of a controller failure, the surviving controller through a *fail-over* process assumes controller operations. The failed controller can then be removed and replaced while the system is still on-line. The new controller resumes processing array operations in a *fail-back* process. During fail-over and fail-back, write cache coherency is maintained with the disk drives.

The FC2500 supports an optional battery back-up unit (BBU) for maintaining memory content in case of an AC power failure. The principle purpose of the BBU is to

provide ride-through during a power glitch; however, the BBU is capable of sustaining memory content for hours at a time.

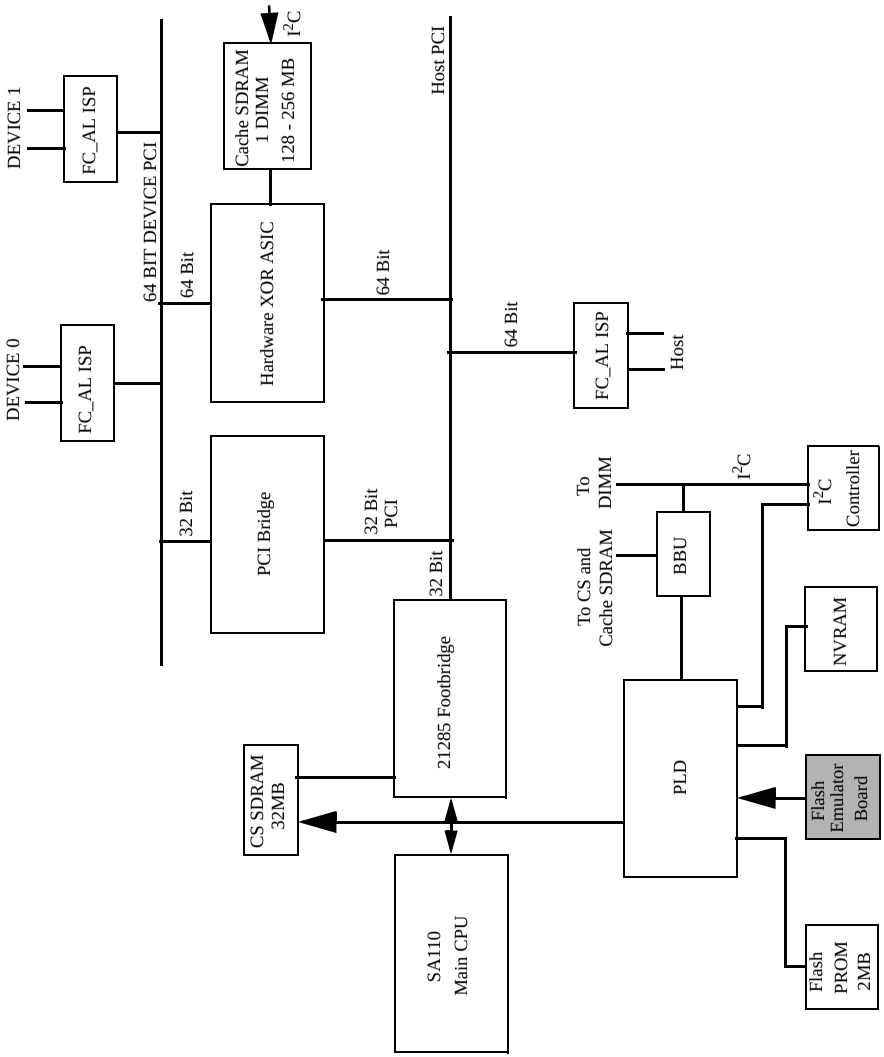
The FC2500 is capable of monitoring a customer provided UPS. The FC2500 controller fault management features are based on the SCSI-3 Enclosure Services (SES) device interface.

An SES firmware process handles all enclosure fault management. The process polls the environment every ten seconds. Failures with disk drives are handled by the FC2500 controller firmware with other failures such as fans, power supplies, and temperature sensors being handled directly by the SES device. The FC2500 controller firmware communicates with the SES device via Send Diagnostics and Receive Diagnostics SCSI commands. The device elements supported by the SES process include: device (disk drive), power supply, cooling, temperature, Enclosure Services, controller electronics, aubible alarm, and uninterruptible power supply.

Hardware Information

This section describes the FC2500 controller hardware. Figure 1-1 shows a block diagram describing the controller board functions. Each of the controller board components are described here also.

Figure 1-1 Block Diagram of Controller Board



Main Processor

The FC2500 RAID controller uses the 233MHz Intel SA 110 StrongARM processor.

Control Store Memory

The FC2500 RAID controller implements separate control store and data cache memory. The control store memory is dedicated to the processor and is located on the processor local bus. The control store memory includes a 32MB 100 Mhz 36-bit parity-protected SDRAM

Flash PROM

One 2MB flash PROM is provided on the controller board for non-volatile storage of the operating program. The SA100 boots from this Flash PROM space.

The Flash PROM device is preprogrammed in manufacturing, but can be updated via firmware download utilities. In the event that a Flash PROM loses all of its contents, including its download utilities, a Flash Emulator board can be attached to the controller and the Flash PROM can be restored by running code on the Emulator Board.

Scalable Cache Memory

The FC2500 RAID controller implements scalable data cache memory on the controller and utilizes ECC protected SDRAM. A single DIMM location accepts Eurologic-qualified, 168-pin, 72-data bit, 100MHz, 3.3V, SDRAM DIMMs. The controller design supports memory capacities 128MB and 256MB. Cache memory is also protected by the Battery Backup Unit (BBU).

UART

One UART provides a debug port operating at 19.2Kbps. This port is used only for development and some field debug situations.

LED Signals

No LEDs are provided on the controller board; however, the following LED signals drive LEDs on the controller face plate: Host Activity, Device Activity, Not Active (Amber), Active (Green), Cache Dirty, Manufacturing Diags On and Partner Fail.

Memory Controller/ Hardware XOR Engine

The FC2500 RAID Controller uses an ASCI for cache data transfer, RAID XOR functional control, and other proprietary functions.

Fibre Channel

Three device ISPs each provide a 1GHz/sec FC_AL class 3 interface. These interfaces adhere to the Fibre Channel Arbitrated Loop Direct Disk Attach Profile. One host ISP supports full duplex, F-ports, IP, Class 2 and Multiple Target IDs (MTIDs); the two remaining ISPs provide the disk interfaces.

Controller Board Connectors

The controller board has two 72-pin edge connectors: one at the front and one at the rear of the board. The connectors provide electrical connection to three fibre channels (one host and two device), loop enable signals, multi-purpose jumper signals, activity and status LED signals, RS232 signals, and the board power and ground signals.

Power Conversion

The FC2500 RAID Controller operates on +5V input power and internally converts +5V to 3.3V as needed. Input power requirements conform to the SFF power limit.

Battery Backup Unit Board

A Battery Backup Unit (BBU) maintains memory content in the event of an AC power failure. The main purpose of the BBU is to provide AC power glitch *ride-through*, however, the BBU is capable of sustaining memory content for an extended period.

The BBU is designed to work with SDRAM memory, and supports both the processor control store and ASIC cache memory SDRAM. The BBU logic detects power loss on the controller and switches the SDRAM to a self-refresh mode while transparently switching the power input from +5V to battery. The BBU can sustain memory content for at least 72 hours[1] under typical operating conditions.

1. This figure can be greater depending on the cache size.

Chapter 2: Installing a RAID Controller

This section will describe the procedure for installing a RAID controller into the SANbloc Series. Also, in this chapter the procedure for upgrading a SANbloc Series from a JBOD (FC2100) to a RAID (FC2500) system is described.

Installing a RAID Controller

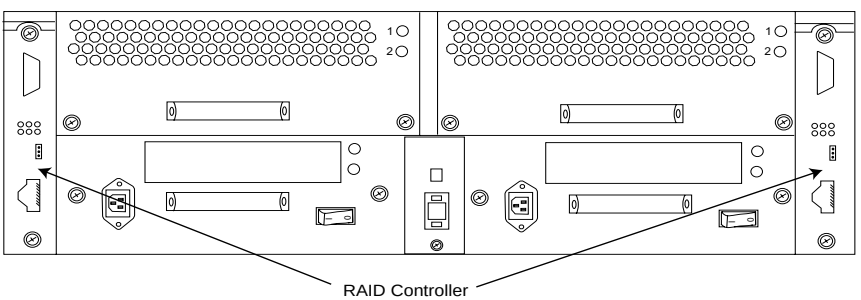
To install a RAID controller, follow this procedure:

The RAID controller is located in the rear of the enclosure. Follow this procedure to install the RAID controller.

Installing a RAID Controller

1. Remove the blank if there is one installed.
2. Gently insert the RAID controller into the slot (see Figure 2-1).
3. Secure in place using the two fixing screws (torque setting 0.3Nm).
4. Connect the cables as described in Chapter 3 of the “SANbloc Series Installation Guide”.

Figure 2-1 Location of the RAID Controller



Upgrading a SANbloc JBOD Array to a RAID Array

In this section the procedure for upgrading a SANbloc Series Storage Array from a JBOD system to a RAID system is described. The equipment and parts necessary for the upgrade are also described.

Equipment and parts necessary for upgrade

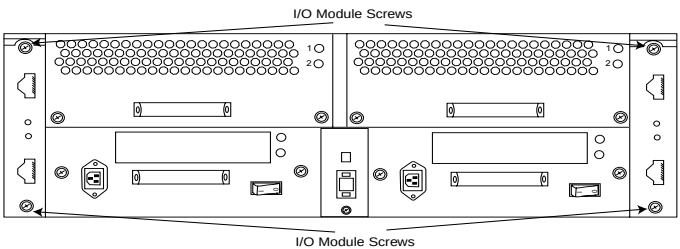
The following is a list of the equipment and parts required for the upgrade from JBOD to RAID:

- Anti-static wrist strap and properly earthed grounding wire.
- Phillips head screw driver.
- FC2500 RAID Controller (2 controllers if dual controller operation is required)
- DB9 host cable to connect RAID controller to host/hub/switch (2 host cables for dual controller configurations).

Upgrading from JBOD to RAID

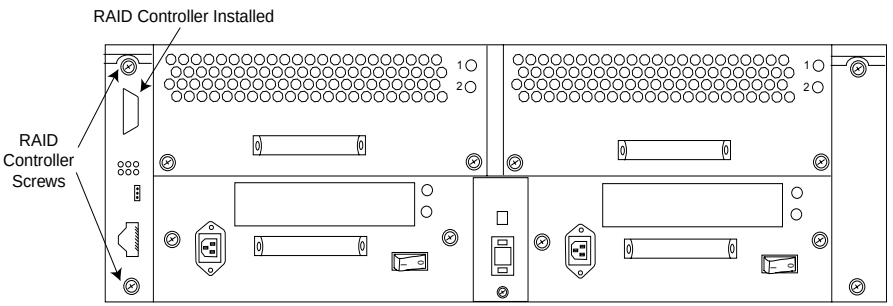
CAUTION: Before beginning the upgrade, ensure that anti-static precautions are taken. The minimum requirement is an anti-static wrist strap and grounding wire.

1. Shut down the system and remove the power cables from the rear of the enclosure.
2. Using the Phillips head screwdriver, loosen the screws securing the I/O Module in the enclosure.



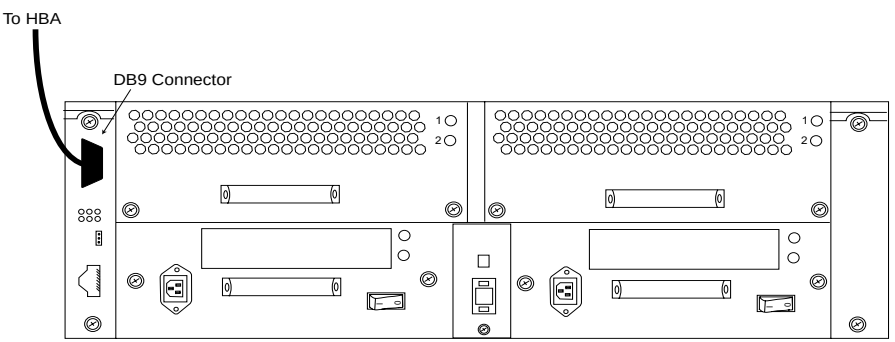
3 Using the handle on the module remove the I/O Module from the enclosure.

4 Into the I/O Module slot install the RAID controller and secure in place by tightening the screws using the Phillips head screw-driver.



5 If you are upgrading to a dual RAID configuration then repeat steps 2 through 4 to install the second RAID controller.

6 Attach the host cable(s) to the DB9 connector on the RAID controller and attach the other end of the cable to your HBA/hub/switch (refer to Chapter 3 “Cabling and Configuration”, of the SANbloc Series Installation Guide, for more details.



7 Install the battery backup unit as described below.

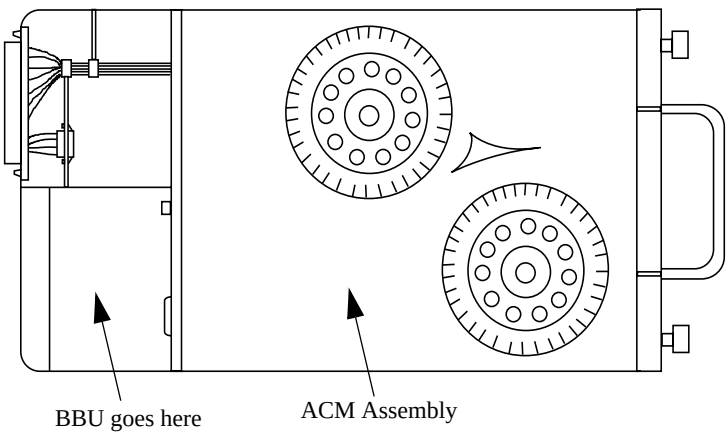
8 Re-attach the power cables and switch on the enclosure.

9 You can now configure your RAID system using the Management Software supplied.

Installing the Battery Backup Unit

The battery backup unit (BBU) for the RAID controller is installed on the ACM unit (see Figure 2-2).

Figure 2-2 Location of Battery Backup Unit on ACM



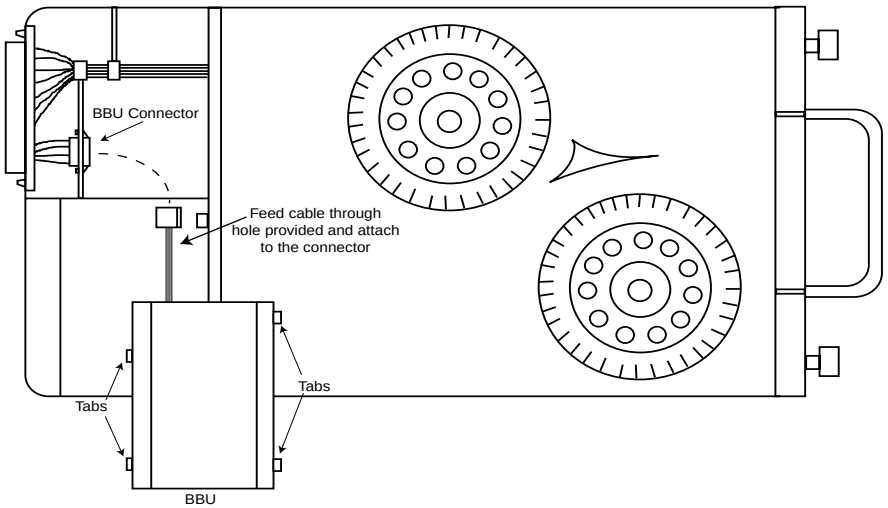
Follow this procedure to install the Battery Backup Unit (BBU):

1 Remove the ACM from the enclosure by loosening the two ACM screws and using the handle, slide the ACM out of the encloure.

2 Lay the ACM on a flat surface as in Figure 2-2 above.

3 Orient the BBU as shown (see Figure 2-3).

Figure 2-3 Installing the BBU



4 Feed the BBU cable through the hole provided and connect it to the BBU connector (see Figure 2-3).

5 Press the BBU into position and secure it by ensuring the four tabs “click” into place.

6 Replace the ACM in the enclosure and tighten the ACM screws to complete the installation.

Chapter 3: Fault Management

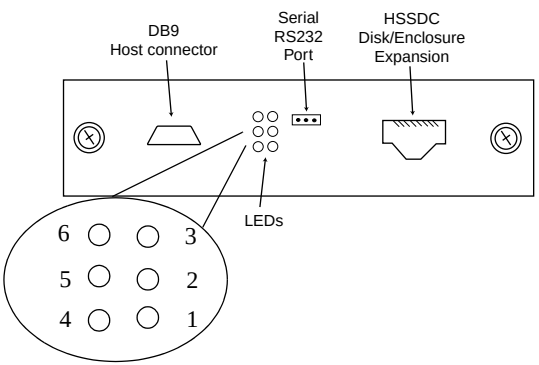
In this section the fault management process of the Series RAID controller is discussed. How to interpret the status LEDs on the front of the controller is also described.

An SES firmware process handles all enclosure fault management. The process polls the environment every ten seconds. The controller firmware communicates with the SES device via Send Diagnostics and Receive Diagnostic SCSI command.

RAID Controller Status LEDs

The main parts of the RAID Controller are shown in Figure 3-1.

Figure 3-1 FC2500 RAID Controller



Fibre Channel RAID Controller LED Definitions

The fibre channel RAID controller has 6 LED indicators as shown above. The LEDs are numbered and defined as follows:

	Description	Color	Indication
LED1	Controller Not Ready	Amber	ON = Controller not ready
LED2	Controller Ready	Green	Normally ON = controller booted successfully
LED3	FC Host port active	Green	ON = activity on host port OFF = no activity on host port
LED4	Controller partner failed	Amber	ON = partner controller detected as failed
LED5	Cache Dirty	Amber	Indicates status of cache memory
LED6	FC Device Port(s) Active	Green	ON = activity on device ports OFF = no activity on device ports

Appendix A: RAID Controller Specifications

This chapter provides the SANbloc Series RAID Controller power requirement, environmental and controller board physical specifications.

Power

This section describes the power requirements, connections and noise tolerances.

Power Requirements

Power requirement: 5.1V +/- 5% @ 2.5 Amps average

Controller operating limits: 5V +/- 5%

CAUTION: The controller will continue operation within the input limits shown. The controller is designed to continue operation outside of these limits, but may begin automatic shutdown processes if input power does not meet this requirement.

Power Connections

GND

Ground connection for the power supply.

VCC

+5.1V +/- 5% @3.5 Amos peak.

Input Noise

Maximum allowable input noise is 100mV peak-to-peak ripple from 0 to 20MHz.

Environmental Specifications

The table below lists the RAID Controller environmental specifications.

	Operating	*Non-Operating (Storage/Shipping)*
Temperature	0°C to 40°C	-20°C to 70°C
Humidity	10% to 90%	10% to 90%
Altitude	To 10,000ft (3,048 m)	To 50,000ft (15,240 m)

MTBF

The table below provides the MTBF values for the RAID Controller.

RAID Controller	
Power-on Hours	167,365 Hr (at 55°C)

Appendix A: Glossary of Terms

Term	Description
Backplane	A PCB into which the controller plugs
C0 / C1	See Master / Slave
C-C Nexus	Controller-to-controller nexus. A configuration of two RAID controllers sharing a common set of drives (see Dual-active mode)
DDA	Direct Disk Attach
DRAM	Dynamic Random Access Memory
Dual-active Mode	A method of interconnecting multiple RAID controllers that share a common set of drives. In addition to increasing overall performance, this method allows a surviving controller to take over resources of a failed controller. This failover process is transparent to the host
Duplex	See dual-active mode
Fail-over	A process whereby a controller puts its partner controller in reset and assumes its duties
Failed controller	A controller that has been determined to be malfunctioning by its partner
FC_AL	Fibre Channel Arbitrated Loop. A direct attachment ANSI architecture interface that supports a maximum of 126 ports
FCP	Fibre Channel Protocol
Hot-plug	(Hot Swap) Hot plug refers to removing and inserting a controller while system power is applied. This can occur while the other controller in a dual-controller implementation is active

Term	Description
I/O	Input / Output
ISP	Intelligent SCSI Processor. Intelligent interface protocol chip
JBOD	Just a Bunch of Disks. A firmware/hardware implementation of a disk array in which data is stored without RAID, or perhaps with a minimal subset of RAID such as mirroring
Logical Unit Numbering (LUN)	A SCSI representation of a system drive on a given channel and target ID
LUN mapping	A process whereby LUNs are mapped to system drives
Master / Slave	Dual-active systems do not really have a master controller and a slave controller, however, the term *master* identifies C0, or the primary controller; the term *slave* identifies C1 or the secondary controller
Partner controller	The other controller in a dual-active controller pair
PCB	Printed Circuit Board
PON	Power ON. A condition where the controller detects +5V power has reached a level suitable for operation
Primary/Secondary Controller	See Master / Slave
RAID	Redundant Array of Independent Disks. A firmware/hardware implementation of a disk array controller in which data is stored on disks in such a manner as to improve performance and avoid data loss if a disk drive fails
SES	SCSI-3 Enclosure Services. Provides a means of SCSI access to multiple devices within an enclosure

Term	Description
SFF	Small Form Factor. Refers to documents controlled by the SFF committee which is made up of a consortium of companies whose purpose is to define the form factor and pinouts of 3.5-inch disk drives
Simplex	See single controller mode
Simplex-only controller	A controller whose firmware is not duplex-enabled in the firmware configuration header
Single controller mode	A single controller attached to a set of drives that offers RAID functionality without the fault tolerance of dual-active mode
System drive	A storage region created out of physical disk drives. One to eight system drives compose the controller's customer data storage area. Each system drive has the attributes of capacity, RAID level, cache write policy, and LUN affinity
SD	System Drive
System drive affinity	System drive affinity is an attribute assigned to a system drive that determines whether that system drive is accessible via all host ports on a single controller, accessible via a single host port on a single controller, or accessible via no host ports
Surviving controller	A controller that has determined that its partner controller in a dual-active pair has failed and has assumed the duties of both controllers. An indication of a surviving controller is stored in NVRAM
UPS	Uninterruptible Power Supply. A large battery back-up module that detects the loss of AC power and provides power to the system